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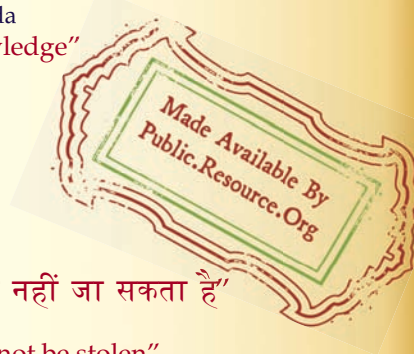
IS 6876 (2003): Technical Characteristics and Testing of Fork Arms for Forklift Trucks [TED 22: Transport Tractors and Trailers]



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भारतीय मानक
कांटा उत्पादक ट्रकों की तकनीकी विशेषताएं तथा
फार्क आर्म का परीक्षण
(पहला पुनरीक्षण)
Indian Standard

TECHNICAL CHARACTERISTICS AND
TESTING OF FORK ARMS FOR
FORKLIFT TRUCKS

(*First Revision*)

ICS 53.060

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Industrial Trucks Sectional Committee had been approved by the Transport Engineering Division Council.

This standard has been prepared as a guide for testing the suitability of fork to be used in forklift trucks and the principal dimensions are specified to promote interchangeability.

This revision was undertaken to bring it in line with ISO 2330 : 2001 'Fork-lift trucks — Fork arms — Technical characteristics and testing', issued by International Organisation for Standardization. In this revision, certain tests have been added such as yield test, impact test, fatigue test and surface crack detection. Marking clause has also been elaborated.

The composition of the Committee responsible for formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

TECHNICAL CHARACTERISTICS AND TESTING OF FORK ARMS FOR FORKLIFT TRUCKS

(First Revision)

1 SCOPE

1.1 This standard covers the recommended sizes of cross-sections of hook on type fork arms as well as length of their blade, for manufacturing and testing of solid fork arms of forklift trucks.

1.2 This standard applies to solid section fork arms to be fitted to all types of forklift trucks.

1.3 By agreement between the fork arm manufacturer and the purchaser, these requirements may also be applied to fork arms not intended for quantity manufacture.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

| IS No. | Title |
|----------------------|--|
| 1757 : 1988 | Method for charpy impact test (V-notch) for metallic material (<i>second revision</i>) |
| 3469 (Part 3) : 1974 | Tolerances for closed die steel forgings (<i>first revision</i>) |
| 7525 : 1974 | Mounting dimensions for fork carriers and fork arms for forklift trucks |
| 7570 : 1975 | Glossary of terms relating to fork arms and attachments of forklift trucks |

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 7570 and the following definition shall apply.

3.1 Prototype Fork Arm — Fork arm intended for quantity production where any combination of the blade, shank cross-section, material specification, hook or fork heel design is new to production.

4 DIMENSIONS AND TOLERANCES

4.1 Dimensions

4.1.1 Nominal Thickness 't' and Nominal Width 'b'

The thickness and width of the fork arms shall be chosen, whenever possible, from the series of recommended dimensions as given in Tables 1, 2 and 3 (*see also* Fig. 1).

4.1.2 Nominal Length 'l'

Length of the blade of the fork arms shall be in relation with the length of the loads to be handled. It shall be chosen from the series of preferred lengths as given in Table 2 (*see also* Fig. 1).

4.2 Tolerances

4.2.1 The tolerances on nominal thickness (*t*), nominal width (*b*) and nominal length (*l*) shall be in accordance with Tables 4 and 5.

Table 1 Nominal Thickness 't'
(Clause 4.1.1)

All dimensions in millimetres.

| t | 25 | 30 | 35 | 40 | 45 | 50 | 60 | 70 | 80 | 90 |
|---|----|----|----|----|----|----|----|----|----|----|
|---|----|----|----|----|----|----|----|----|----|----|

Table 2 Nominal Width 'b' and Nominal Length 'l'
(Clauses 4.1.1 and 4.1.2)

All dimensions in millimetres.

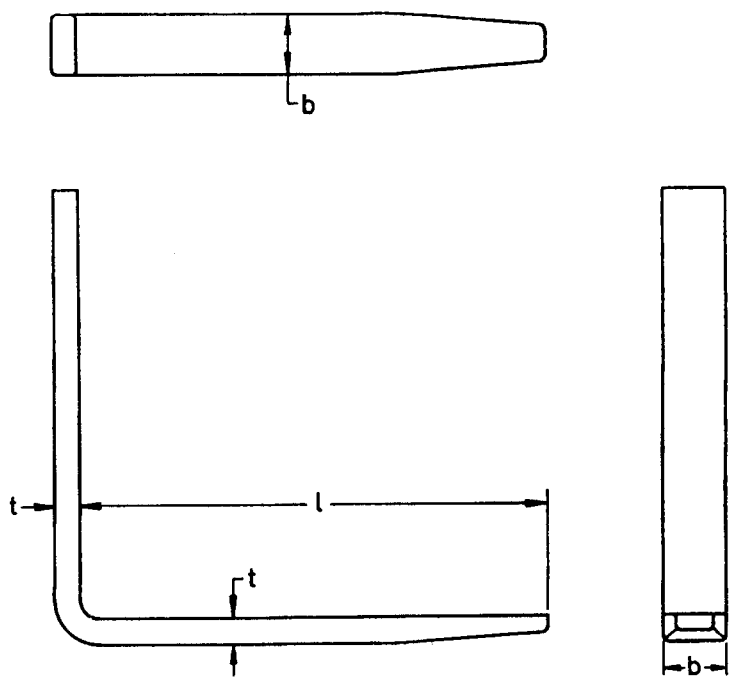
| b | 80 | 100 | 120 | 125 | 140 | 150 | 160 | 180 | 200 | — | — | — |
|---|-----|-----|-----|-----|-------|-------|-------|-------|-------|-------|-------|-------|
| l | 750 | 800 | 900 | 950 | 1 050 | 1 150 | 1 200 | 1 250 | 1 350 | 1 500 | 1 600 | 1 650 |

Table 3 Recommended Sections for Fork Arms
(Clause 4.1.1)

All dimensions in millimetres.

| Ab | 80 | 100 | 120 | 125 | 140 | 150 | 160 | 180 | 200 |
|----|----|-----|-----|-----|-----|-----|-----|-----|-----|
| 25 | x | — | — | — | — | — | — | — | — |
| 30 | x | x | — | — | — | — | — | — | — |
| 35 | — | x | x | x | — | — | — | — | — |
| 40 | — | x | x | x | — | — | — | — | — |
| 45 | — | — | x | x | x | x | x | — | — |
| 50 | — | — | x | x | x | x | x | — | — |
| 60 | — | — | — | — | x | x | x | x | x |
| 70 | — | — | — | — | — | — | — | x | x |
| 80 | — | — | — | — | — | — | — | — | x |
| 90 | — | — | — | — | — | — | — | — | x |

NOTE — x = Recommended sections.



All dimensions in millimetres.
FIG. 1 DIMENSIONS OF FORK ARM

Table 4 Tolerance on Thickness 't' on Dimensional Basis
(Clauses 4.2.1 and 4.2.2)

| Sl No. | Thickness <i>t</i> | $\frac{l}{b}$ | Tolerance on Thickness for Length | | | | | | | |
|--------|------------------------|---------------|-----------------------------------|----------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------|---------------------------------|---------------------------------|
| | | | Up to 50 | Over 50 Up to 120 | Over 120 Up to 250 | Over 250 Up to 500 | Over 500 Up to 800 | Over 800 Up to 1 200 | Over 1 200 Up to 2 000 | Over 2 000 Up to 2 500 |
| (1) | (2) | (3) mm | (4) mm | (5) mm | (6) mm | (7) mm | (8) mm | (9) mm | (10) mm | (11) mm |
| i) | Up to 30 | <2 | 1.6 | 2.0 | 2.5 | — | — | — | — | — |
| | | 2 to 5 | 1.2 | 1.6 | 2.0 | — | — | — | — | — |
| | | >5 | 1.2 | 1.6 | 1.6 | — | — | — | — | — |
| ii) | Above 30 Up to 50 | <2 | 1.6 | 2.0 | 2.5 | 4.0 | 4.5 | — | — | — |
| | | 2 to 5 | 1.6 | 2.0 | 2.0 | 3.5 | 4.0 | — | — | — |
| | | >5 | 1.6 | 1.6 | 2.0 | 3.5 | 3.5 | — | — | — |
| iii) | Above 50 Up to 80 | <2 | — | 2.5 | 3.0 | 4.5 | 5.0 | 5.5 | 7.0 | 8.0 |
| | | 2 to 5 | — | 2.0 | 2.5 | 3.5 | 4.0 | 5.0 | 5.0 | 7.5 |
| | | >5 | — | 2.0 | 2.5 | 3.0 | 3.5 | 4.5 | 5.0 | 6.5 |
| iv) | Above 80 Up to 120 | <2 | — | 2.5 | 3.0 | 4.5 | 5.5 | 6.5 | 8.0 | 9.5 |
| | | 2 to 5 | — | 2.5 | 2.5 | 4.0 | 4.5 | 5.0 | 6.5 | 8.0 |
| | | >5 | — | 2.5 | 2.5 | 3.5 | 4.0 | 4.5 | 5.5 | 7.0 |
| v) | Above 120 Up to 150 | <2 | — | — | 3.5 | 4.5 | 5.5 | 6.5 | 8.5 | 10.5 |
| | | 2 to 5 | — | — | 3.0 | 4.0 | 4.5 | 5.0 | 6.5 | 8.0 |
| | | >5 | — | — | 2.5 | 3.5 | 4.0 | 4.5 | 5.5 | 7.0 |
| vi) | Above 150 Up to 180 | <2 | — | — | 3.5 | 5.0 | 5.5 | 6.5 | 8.5 | 10.5 |
| | | 2 to 5 | — | — | 3.0 | 4.5 | 5.0 | 5.5 | 6.5 | 8.0 |
| | | >5 | — | — | 3.0 | 4.0 | 4.5 | 5.0 | 5.5 | 7.0 |

Table 5 Tolerance on Length 'l' and Width 'b' on Dimensional Basis
(Clauses 4.2.1 and 4.2.2)

All dimensions in millimetres.

| Sl No. | Thickness <i>t</i> | $\frac{l}{b}$ | Tolerance on Length and Width | | | | | | | |
|--------|------------------------|---------------|-------------------------------|----------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------|---------------------------------|---------------------------------|
| | | | Up to 50 | Over 50 Up to 120 | Over 120 Up to 250 | Over 250 Up to 500 | Over 500 Up to 800 | Over 800 Up to 1 200 | Over 1 200 Up to 2 000 | Over 2 000 Up to 2 500 |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| i) | Up to 30 | <2 | 1.6 | 2.0 | 2.5 | — | — | — | — | — |
| | | 2 to 5 | 1.0 | 1.2 | 2.0 | — | — | — | — | — |
| | | >5 | 1.0 | 1.2 | 2.0 | — | — | — | — | — |
| ii) | Above 30 Up to 50 | <2 | 1.6 | 2.0 | 2.5 | 4.0 | 4.5 | — | — | — |
| | | 2 to 5 | 1.0 | 1.2 | 2.0 | 3.5 | 5.0 | — | — | — |
| | | >5 | 1.0 | 1.2 | 2.0 | 3.5 | 5.0 | — | — | — |
| iii) | Above 50 Up to 80 | <2 | — | 2.5 | 3.0 | 4.5 | 5.0 | 5.5 | 8.0 | 10.0 |
| | | 2 to 5 | — | 1.2 | 2.0 | 3.5 | 5.0 | 7.0 | 10.0 | 13.5 |
| | | >5 | — | 1.2 | 2.0 | 3.5 | 5.0 | 7.0 | 10.0 | 13.5 |
| iv) | Above 80 Up to 120 | <2 | — | 2.5 | 3.0 | 4.5 | 5.5 | 6.5 | 8.0 | 10.0 |
| | | 2 to 5 | — | 1.2 | 2.0 | 3.5 | 5.0 | 7.0 | 10.0 | 13.5 |
| | | >5 | — | 1.2 | 2.0 | 3.5 | 5.0 | 7.0 | 10.0 | 13.5 |
| v) | Above 120 Up to 150 | <2 | — | — | 3.5 | 4.5 | 5.5 | 6.5 | 8.5 | 11.0 |
| | | 2 to 5 | — | — | 2.0 | 3.5 | 5.0 | 7.0 | 10.0 | 13.5 |
| | | >5 | — | — | 2.0 | 3.5 | 5.0 | 7.0 | 10.0 | 13.5 |
| vi) | Above 150 Up to 180 | <2 | — | — | 3.5 | 5.0 | 5.5 | 6.5 | 8.5 | 11.0 |
| | | 2 to 5 | — | — | 2.0 | 3.5 | 5.0 | 7.0 | 10.0 | 13.5 |
| | | >5 | — | — | 2.0 | 3.5 | 5.0 | 7.0 | 10.0 | 13.5 |

4.2.2 The values given in Tables 4 and 5 are adopted from IS 3469 (Part 3).

NOTE — Tolerances given in Tables 4 and 5 shall apply to fork arms when manufactured by drop forging or press forging.

4.3 Other Dimensional Details

The dimensions of suspension hooks and their location on the fork shank shall be in accordance with IS 7525.

5 MANUFACTURE

5.1 Materials

The material, and if necessary the heat treatment, shall be selected in such a way that the finished fork complies with the provisions of 6.

5.2 Method of Manufacture

The method of manufacture shall be determined by the forklift truck manufacturer.

6 TESTING

6.1 A prototype fork arm shall be subjected to, and meet the requirements, of the yield test in 7 and the impact test in 8.

6.1.1 Prototype fork arms each having a specified capacity not greater than 4 000 kg shall be subjected to and meet the requirements of the fatigue test in 9.

6.2 The tests in 7 and 8 may, by agreement between the fork arm manufacturer and the purchaser, be repeated periodically for quantity production fork arms.

7 YIELD TEST

7.1 Test Load

7.1.1 Fork Arms Each of Specified Capacity Up to and Including 5 000 kg

The test loaded F_T (see Fig. 2) shall correspond to three times the specified capacity C of the fork arm.

7.1.2 Fork Arms Each of Specified Capacity Greater than 5 000 kg

The test load F_T shall correspond to the specified capacity C of the fork arm multiplied by the factor R , where R is given as follows:

$$R = 3 - 0.08 (Q - 10)$$

where

$$R > 2.5$$

$$Q = \frac{2C}{1000}$$

7.2 Procedure

7.2.1 Restrain the fork arm in a manner identical to that used on the forklift truck. Fit the fork arm with a means of measuring any permanent deformation.

7.2.2 Apply the appropriate yield test load twice at the distance D from the front face of the fork arm shank (see Fig. 2), gradually and without shock; maintain it for 30 s each time. For fork arms each of specified capacity below 5 500 kg, D shall be taken as the appropriate rated load centre distance as specified in Table 1 of IS 7525. For fork arms each of specified capacity of 5 500 kg and above, D shall be specified by the truck manufacturer.

7.3 Requirement

Datum readings shall be taken on the top surface of the fork blade tip after the first test and again after the second test. Comparison between these two readings shall indicate no permanent deflection.

8 IMPACT TEST

8.1 Sampling

8.1.1 Specimens longitudinal to the grain shall be taken in relation to the fork arm section in accordance with the location of test pieces in bars and wire rods. These shall preferably be taken from an area between the top and bottom hooks, but it is also permissible to take specimens from a specially provided extension of the fork shank above the top hook or from a separate piece of semi-finished material of adequate size (that is length at least twice the width), which has the same cross-section, has been taken from the same material batch and has received the same heat treatment as the fork arm itself.

8.2 Procedure

The impact test should be carried out in accordance with IS 1757 using standardized V-notched samples, at a temperature of -20°C .

8.3 Requirement

The samples shall achieve an impact value of at least 27 J at -20°C .

9 FATIGUE TEST

9.1 Test Load Magnitude, Frequency and Duration

9.1.1 The dynamic test load shall be of constant amplitude and have a peak magnitude of 1.25 times the specified capacity C . The minimum value for the dynamic test load shall not exceed 0.1 times the specified capacity C .

9.1.2 The test load frequency shall be 10 Hz maximum. The frequency shall be reduced if the temperature of the fork arm exceeds 50°C , or if resonance symptoms occur.

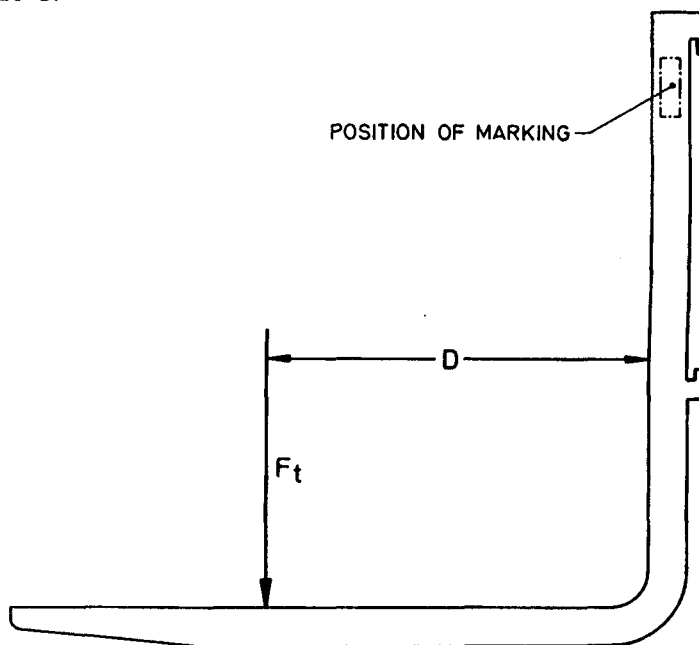
9.1.3 The duration of the test shall be not less than 10^6 test load cycles.

9.2 Procedure

Restrain the fork arm in a manner identical to that used on the forklift truck. Apply the dynamic test load at the distance from the front face of the fork arm shank where D is as specified in 7.2 (see also Fig. 2).

9.3 Requirement

There shall be no cracks or permanent deformation in the fork arm on completion of the test. The crack detection procedure shall be as specified in 10.



All dimensions in millimetres.

FIG. 2 POSITION OF MARKING AND TEST LOADS APPLICATION POSITION

10 SURFACE CRACK DETECTION

The fork arm manufacturer shall visually examine every fork arm in quantity production thoroughly (or following a fatigue test) for cracks, and subject them to a non-destructive crack detection process with special attention being given to the heel and any welds and heat-affected zones at the top and bottom hooks, including their attachment to the shank. The fork arm shall be withdrawn, if indications of cracking are detected.

NOTE — It is recommended that the non-destructive crack detection process be carried out by the magnetic particle inspection method.

11 PAIRING OF FORKS

The difference in height at the tip between any two fork arms of a forklift truck shall not be more than 6 mm in unloaded condition.

12 MARKING

12.1 At the position indicated in Fig. 2 (on either face), each fork arm shall be marked permanently with

the following:

- a) Specified fork arm capacity C , in kg;
- b) Specified load centre distance D , in mm;
- c) Fork arm manufacturer's identification; and
- d) Week or month and year of manufacture or agreed serial number.

12.2 The truck manufacturer's identification and part number may be shown if requested.

12.3 BIS Certification Marking

The fork arms of the forklift trucks may also be marked with the Standard Mark.

The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Industrial Trucks Sectional Committee, TED 23

| <i>Organization</i> | <i>Representative(s)</i> |
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| Macneill Engineering Ltd, Kolkata | SHRI S. RAYCHOUDHARY (<i>Chairman</i>) |
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Scientist E & Director (TED), BIS

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

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BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
Telephones : 2323 0131, 2323 33 75, 2323 9402

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices :

| | Telephone |
|---|--|
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| Eastern : 1/14 C.I.T. Scheme VII M, V. I. P. Road, Kankurgachi KOLKATA 700 054 | { 2337 8499, 2337 8561 2337 8626, 2337 9120 |
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